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2011 Independent Validation & Verification Workshop

September 13 - 15, 2011

Hosted by

West Virginia University's

Erickson Alumni Center

Morgantown, West Virginia

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“Most engineers are taught to look at things from the viewpoint of what you want a system to do. What about the things you don’t want it to do? That’s all that safety is. Forcing people to think about what they don’t want the system to do.”

-Nancy Leveson

The NASA IV&V Program has chartered a course for arriving at the single most important goal of our Program, to ensure that no software error will go undetected that can adversely affect the safety or success of our missions. The significant amount of attention given to this endeavor goes without question and our vigilance in the pursuit of excellence and in reaching new heights to enable this to be realized is of our highest priority. With that in mind, we will knowingly climb to these heights and engage in challenges that are going to be unique to our time. Challenges such as rapidly acquiring an understanding of the system and maintaining that domain knowledge, applying resources most efficiently to the most critical areas of the software, applying required amounts of engineering rigor that clearly and repeatedly conclude the quality of the software, etc... Armed with a “yes if” attitude and an unprecedented amount of domain knowledge; equipped with advanced tools and a multitude of engineering approaches we will be ready to technically conclude whether or not mission software is reliable and safe to operate.

Our understanding for how system software should behave within known and unknown environmental conditions, under various operational configurations, and within specific design constraints, and in the presence of a multitude of failure scenarios is one of the most difficult things to achieve. It is probably impossible if the problem is not bounded. There is no analytical technique that can replace the human having a thorough understanding of the system software. But that is not the intent; our intent is to arm the engineer with advanced tools and additional perspectives that enable him/her to bring clarity to the complexities resulting from interconnected components.

With limited resources we must use them wisely and strategically so that aspects of the system in which an error would be mission ending is the highest priority. We must clearly understand where a failure in the software could possibly result in the end of the mission. We must use our resources efficiently and use technology where we can gain efficiencies yet maintain our engineering excellence. Optimization of resources is not easy and must be figured into the equation of balancing the risk, we must understand the priority of our work and which aspects of the system must be independently verified and validated but we must do it effectively.

We must conduct our analysis with the utmost rigor, constantly investigating how the software can fail and how the software can keep the mission from failing. We must produce analytical evidence that clearly shows that the software can or cannot handle failures and can or cannot prevent emergent behaviors from surfacing. This is not a documentation exercise but an exploration by systems engineers seeking to not only understand the behaviors of system software but also seeking how it can fail. A mission ending failure caused by or one that could have been prevented by the software is unacceptable, it is our job to ensure the most difficult and hard to find software errors are discovered and resolved before we operate our missions.

In 2012, the NASA IV&V Program will go beyond the cutting-edge by addressing numerous items. We will become more efficient with our analytical methods, we will repeatedly produce empirical evidence that clearly concludes whether or not (i) the software does what it is supposed to do (ii) the software will guard against or prevent undesired behaviors from surfacing within the context of the operational environment, and (iii) the system software will behave reliably in the presence of failures. The Program will push the envelope of technology by establish a roadmap for tooling and research. The Program will invest into exploration providing solutions for this roadmap. The Program will establish effective mechanisms to explore and gain understandings of the systems behavior under a multitude of conditions. The Program will invest in and establish the right amount of rigor needed to arguably show the system software will or will not work if operated. The Program will explore and yield new approaches that allow us to work on more aspects of the system using fewer resources. The Program will embark on an outreach initiative that pushes the educational system towards making the engineering of space flight systems common knowledge. The Program will utilize this outreach initiative to maintain our domain knowledge while exploring innovative ideas that advance IV&V and systems and software engineering. The Program’s initiative will be the first spacecraft built by the Program with a team of students and IV&V engineers and we are set to fly in the summer of 2012.

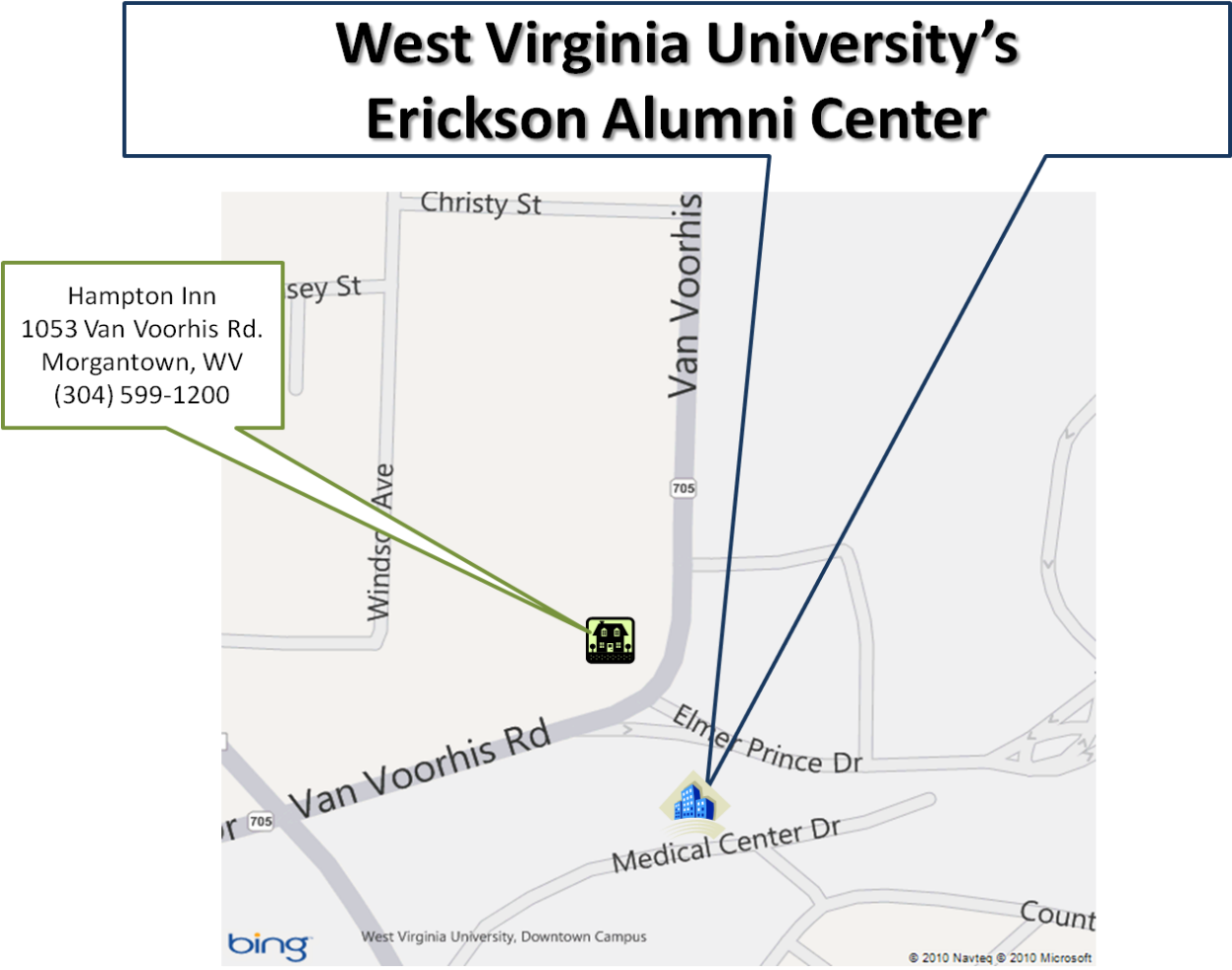
This endeavor will become a chapter in the history books for our Program, one that describes a time, a workforce, the grand challenges posed, and how the IV&V Program persevered. This endeavor will challenge our scientific and engineering backbones and it will be riddled with unknowns. But our actions will be purposeful and rooted in an overarching strategic plan. Take away the challenges I presented above and challenge this forum in which we look towards sharing knowledge and ideas that will ultimately make us more efficient and effective at performing IV&V.

Marcus Fisher

Associate Director, NASA IV&V Program

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Demonstrations		
September 14 @ 11: 15 AM	<i>Through the Looking Glass</i>	S. Brown
	<i>NASA's Electronic Software Engineering Handbook</i>	J. Verville
September 14 @ 1: 00 PM	<i>ITC Framework Version 1.0</i>	S. Carroll, J. McCarty, S. Seeger
	<i>Modeling IV&V</i>	K. Frank, T. Gullion, D. Kranz, H. Layne, G. Marchiny
September 15 @ 1:00 PM	<i>Improving Productivity Using Visual Basic</i>	T. Marshall
	<i>Integrating Eclipse and FlexeLint and Beyond</i>	J. Chamberlain, J. Schipper, J. Williams

Posters	
<i>Transformation for a System of Systems Dependability Safety Case</i>	S. Driskell, J. Murphy
<i>NASA's Electronic Software Engineering Handbook</i>	K. Carmichael
<i>IV&V Perspective on Recent Trends in Executable Models</i>	T. Gullion
<i>Managing IV&V Analysis of Products of an Agile Development Processes</i>	N. Saito
<i>UML Model Consistency Checking for IV&V</i>	C. Cover, M. Facemire
<i>Unfinished Business: Finding FIXMEs, TODOs & loose ends in flight software</i>	K. Ritchie, J. Cox
<i>Modeling IV&V</i>	D. Kranz
<i>Developing Tools to Identify Requirement Inconsistencies and IV&V Change Impact</i>	J. Fienhold
<i>IV&V of MPCV Project Model-Based Design Software</i>	G. Black
<i>So What? - A Structured Approach to Developing TIM Impact Statements</i>	P. Olguin
<i>Validating and Verifying Design</i>	H. Layne, G. Marchiny
<i>IV&Ving Design Consistency</i>	G. Marchiny
<i>IV&Ving Design against Requirements</i>	H. Layne
<i>Importance of Software Build Systems and Configuration Management</i>	S. Seeger
<i>NASA IV&V Independent Test Capability (ITC)</i>	B. Bailey, J. Morris
<i>NASA IV&V Space Flight Design Challenge</i>	M. Fisher

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September 13, 2011		
8:30 AM	Welcome	
8:45 AM	<i>IV&V Lessons Learned: Phoenix/GRAIL/MAVEN</i>	S. Larson, S. Raque
9:15 AM	<i>Measuring IV&V Impact on Risk Reduction</i>	G. Barber
9:45 AM	<i>Jon McBride Software Testing & Research Lab (JSTAR)</i>	B. Bailey, J. Morris
10:15 AM	<i>On-Orbit Anomaly Research</i>	NASA IV&V On-Orbit Anomaly Research Team
10:45 AM	Break	
11:00 AM	<i>Panel Discussion: The Value of IV&V</i>	E. Andrews & R. Sabatino (NASA / GSFC) S. Krasner & S. Larson (NASA / JPL)
12:00 PM	Lunch Reception with Special Key Note Speaker, Astronaut Ken Cameron	MPL Corporation
1:00 PM	Poster Sessions/Demonstrations in the Gallery	
2:00 PM	<i>Animating Models atop Open Source Technologies</i>	T. Gullion
2:30 PM	<i>Vulnerability Assessment as an Aid for Test Plan Design Verification</i>	A. Coletti, K. Lateef
3:00 PM	Break	
3:15 PM	<i>NASA's Electronic Software Engineering Handbook</i>	K. Carmichael, K. Malnick, J. Verville
3:45 PM	<i>ESA Flight Software Testing and its Independent Verification</i>	M. Hernek, M. Prochazka
4:15 PM	<i>Through the Looking Glass</i>	S. Brown
5:00 PM	Evening Reception featuring the NASA IV&V House Band	TASC, Inc.

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September 14, 2011		
8:30 AM	Cross-Project IV&V Software Technologies & Tools	J. Joltes, D. Nawrocki, S. Seeger
9:00 AM	GPM IV&V: ITC Testing Process and Analysis	B. Cox, A. Lagoy, A. Robinson
9:30 AM	IV&V Technical Rigor	J. Northey, S. Savarino
10:00 AM	Break	
10:15 AM	COEST's TRACELAB: Infrastructure for Traceability Researchers and Practitioners	J. Cleland-Huang, J. Hayes
10:45 AM	IV&V of a Space Robotic Mission's Fault Protection System	M. Choppa, F. Huy, S. Savarino
11:15 AM	Poster Sessions/Demonstrations in the Gallery	
12:00 PM	Awards Luncheon	Allegheny Science & Technology/ KeyLogic
1:00 PM	Poster Sessions/Demonstrations in the Gallery	
2:00 PM	Panel Discussion: NASA IV&V Project Lifecycle and Support	S. Husty, F. Huy, P. Loftis, J. Loretta, D. Painter, S. Seeger, W. Stanton, P. Theeke, S. White,
3:00 PM	Break	
3:15 PM	GPM Health & Safety Dynamic Software Testing	P. Wheeler
3:45 PM	Introduction of JAXA IV&V Manual	T. Matsumoto, H. Umeda
4:15 PM	IV&V of the ISS Canadian-provided Mobile Servicing System Displays	C. Price
5:00 PM	Evening Reception	L-3 Stratis

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September 15, 2011		
8:45 AM	Improving Productivity USING Visual Basic	T. Marshall
9:15 AM	Streamlining Scientific Instrument Validation	M. Egbert
9:45 AM	Integrating Eclipse with FlexeLint and Beyond	J. Chamberlain, J. Schipper, J. Williams
10:15 AM	Formal Methods for System/Software Engineering: NASA and Army Experiences	M. Hinchey, J. McNeil, C. Wang
10:45 AM	Break	
11:00 AM	IV&V for Projects using Code Generators	K. Frank, T. Gullion
11:30 AM	Software Faults, Failures, and Fixes: Lessons Learned from a Large NASA Mission	K. Goseva-Popstojanova, M. Hamill
12:00 PM	Lunch Reception with Distinguished Speaker, Dr. Earl Scime	Galaxy Global Corporation
1:00 PM	Poster Sessions/Demonstrations in the Gallery	
2:00 PM	Dynamic Design Verification	K. Frank, T. Gullion, D. Kranz
2:30 PM	Keeping Models Current: Aging and Surveillance of Solid Rocket Motors	M. Ellis, K. Morgan, C. Pascua, B. Poveda
3:00 PM	Break	
3:15 PM	Agile/Iterative/Incremental Verification & Validation Processes	J. Roadcap
3:45 PM	Architecture Analysis Techniques	J. Dabney, H. Haga, D. Ohi
4:15 PM	Closing	

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